Aug. 26, 1924. 1,506,486

A. W. HULL

ELECTRIC OSCILLATOR

Filed March 1, 1920

Fig. 1.

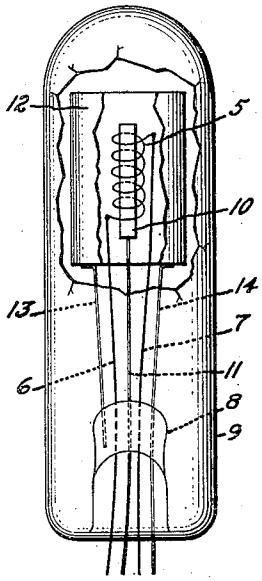


Fig. 2.

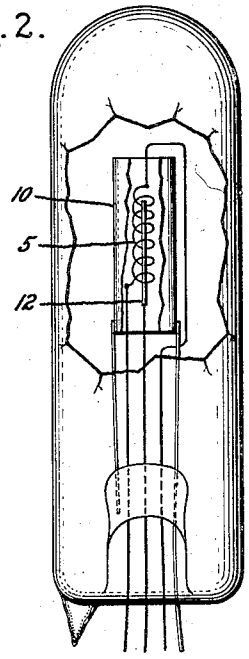


Fig. 3.

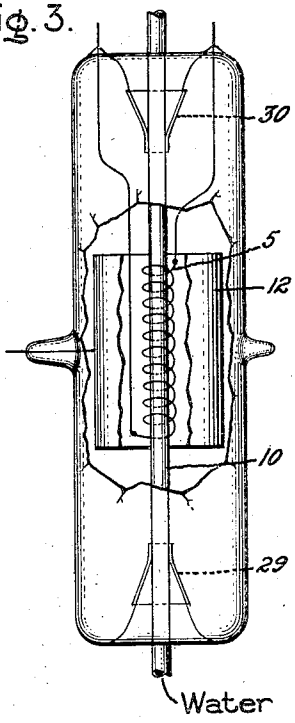


Fig. 4.

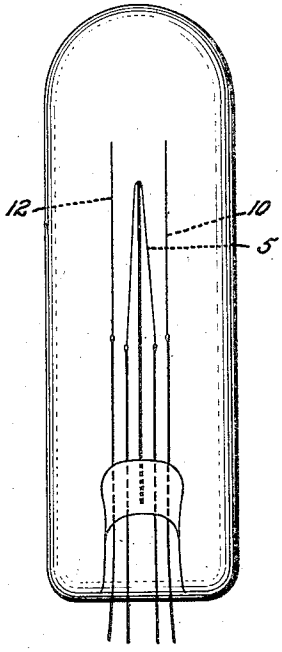
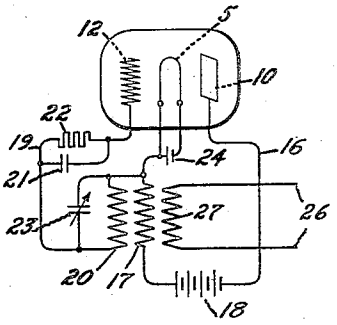


Fig. 5.



Inventor:
Albert W. Hull,
by Albert G. Davis
His Attorney.

Patented Aug. 26, 1924. 1,506,486

UNITED STATES PATENT OFFICE.

ALBERT W. HULL, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC OSCILLATOR.

Application filed March 1, 1920. Serial No. 362,483.

To all whom it may concern:

Be it known that I, ALBERT W. HULL, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Electric Oscillators, of which the following is a specification.

The present invention comprises an apparatus adapted to efficiently produce alternating currents of desired frequency from a suitable source of either direct or alternating current, and particularly currents of very high frequency.

Heretofore, oscillators of the pliotron type as described in an article by Dr. Irving Langmuir in the Proceedings of the Institute of Radio Engineers, volumes 1–3, p. 261, containing an electron-emitting cathode, an anode and a grid, have been constructed with the grid located between the cathode and the anode. When it has been attempted to use oscillators of this type with even moderately high voltages, trouble has been experienced with a deleterious heating of the grid. In many cases the grid has been unexpectedly melted or burnt out during the operation of the oscillator. I have discovered that this tendency of the grid to heat up is due to a secondary electron emission from the grid when the grid is positive.

It is the object of my present invention to avoid this deleterious overheating by constructing a device which can be efficiently operated as an oscillator without making the grid positive. In accordance with my invention I have provided an oscillator in which the cathode and anode are placed close to each other and the control electrode or grid is so placed to exercise a weak electrostatic control, preferably being located on the side of the cathode which is opposite the anode.

In the accompanying drawing Figs. 1 to 4 illustrate different embodiments of my invention; Fig. 5 is a diagram illustrating one form of oscillator connections.

In the modification illustrated by Fig. 1, the helical cathode 5, consisting of some suitable refractory metal, such, for example, as tungsten, is mounted upon conductors 6 and 7 sealed into a stem 8 of a sealed envelope 9. The anode 10 located within the coils of the cathode 5 also consists of refractory metal, preferably tungsten, and is mounted upon a wire 11 also sealed in the stem 8. The outer electrode 12 consists of thin foil of suitable metal, such as molybdenum, and conveniently assumes the shape of a cylinder. This control electrode 12 is mounted upon two stiff wires 13, 14, sealed into the stem 8, electrical connection being made by the wire 14 which projects through the envelope 9. As the electrode 12 is not located between the cathode and anode its electrostatic control of an electron current passing between cathode and anode is relatively weak. This is advantageous, for when the control electrode is at the same potential as the cathode it does not appreciably decrease the current between the cathode and the anode. The relatively small electrostatic control hereby afforded is compensated by operating the oscillator in such a manner that the control electrode varies in potential between the cathode potential and a relatively large negative potential.

One system of connections suitable for use with a device embodying my invention is illustrated in Fig. 5 which shows the cathode 5 and the anode 10 connected to an oscillating circuit 16 containing an inductance 17 and a suitable source of current, as represented by a battery 18. The control electrode 12 is connected to the cathode 5 through a circuit 19 containing inductance 20 and a condenser 21. This condenser 21 is shunted by a resistance 22. The inductances 17 and 20 are loosely coupled. The inductance 20 may be shunted by an adjustable condenser 23 whereby the frequency of the oscillations to be generated may be controlled.

When the cathode is heated to incandescence by some suitable source, such as the battery 24, current will flow in the circuit 16. The flow of current through the inductance 17 induces a flow of current in the inductance 20, which builds up a negative potential in the control electrode 12 sufficient to cut down the flow of current in the circuit 16. By suitably proportioning the condenser 21 and the resistance 22, the control electrode 12 will vary between filament potential and a relatively high negative potential. The result will be an oscillating flow of current in the circuit 16, depending on the electrical constants of the grid circuit 19. In this manner alternating current of any desired frequency may be obtained in a

work circuit 26 by closely inductively coupling a winding 27 of the work circuit to the inductance coil 17.

In the modification shown in Fig. 2, the anode 10 consists of a cylinder surrounding and located closely adjacent to a helical cathode 5. The control electrode 12 in this case consists of a rod-like member located in the space enclosed by the turns of the cathode.

As shown in Fig. 3, the anode may be artificially cooled. The device shown in this figure contains an anode 10 consisting of a tube through which is conducted a cooling fluid, such as water. This tube, consisting of copper, or other suitable metal, is soldered or welded to collars of platinum 29, 30 which are sealed into the glass envelope. The coiled cathode 5 and the control electrode 12 correspond in construction and arrangement to the corresponding members of the device shown in Fig. 1.

In Fig. 4 the control electrode 12 consists of a plate or strip of suitable metal which is located on one side of the V-shaped cathode 5. On the opposite side of the cathode is located the anode 10, which also consists of a plate or strip of suitable metal.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. An apparatus for producing electrical oscillations comprising an electron discharge device having an anode, an electron emitting cathode and a discharge controlling member, said cathode being located between said anode and said discharge controlling member and being relatively closer to said anode, circuit connections between said cathode and anode and between said cathode and discharge controlling member, said circuit connections being coupled together to permit the production of oscillations, and means for maintaining said control member during the entire time that oscillations are being produced at a potential which varies between the potential of the cathode and a potential which is negative with respect to the cathode.

2. An apparatus for producing electrical oscillations comprising an electron discharge device having an anode, an electron emitting cathode and a discharge controlling member, said cathode being located between said anode and said discharge controlling member, circuit connections between said cathode and anode and between said cathode and discharge controlling member, said circuit connections being coupled together to permit the production of oscillations, and means for maintaining said control member during the entire time that oscillations are being produced at a potential which varies between the potential of the cathode and a potential which is negative with respect to the cathode.

In witness whereof, I have hereunto set my hand this 28th day of February, 1920.

ALBERT W. HULL.